Steam-Based Interactive Teaching Media In Ips Lessons For V Sd Students

Ni Putu Ashya Paramitha Sari[1*], I Gusti Agung Ayu Wulandari [2] Gusti Ngurah Sastra Agustika[3] (iD)

[1,2] Program Studi Pendidikan Dasar, Universitas Pendidikan Ganesha, Singaraja, Indonesia
*Corresponding author: ashya@undiksha.ac.id

Abstrak

Kurangnya pemahaman siswa terhadap materi pembelajaran IPS karena media ajar yang tersedia sangat terbatas. Didalam pembelajaran jarak jauh seperti ini sangat diperlukannya media ajar yang interaktif dan dapat meningkatkan pembelajaran yang baik. Penelitian ini bertujuan untuk menghasilkan media ajar interaktif berbasis STEAM pada pelajaran IPS siswa kelas V SD. Penelitian ini menggunakan model ADDIE. Subjek dalam penelitian ini adalah 1 orang ahli isi mata pelajaran, 1 orang ahli desain dan media pembelajaran dan siswa kelas V yang berjumlah 25 orang. Metode pengumpulan data pada penelitian ini adalah tes yaitu tes objektif dan non tes yaitu angket kuisioner. Hasil penelitian didapatkan dari hasil uji ahli isi mata pelajaran yaitu 89.58%, uji desain pembelajaran 96.42%, uji ahli media pembelajaran 93.75%. uji perorangan 92.5%, uji kelompok kecil 91.66%, dan uji lapangan 86.1%. Dari hasil penelitian, media ajar berbasis STEAM baik digunakan dalam pembelajaran IPS siswa kelas V SD. Penelitian ini menghasilkan media ajar interaktif berbasis STEAM untuk dapat meningkatkan pembelajaran yang baik.

Kata Kunci: Media ajar, Pembelajaran IPS, STEAM.

Abstract

Lack of students' understanding of social studies learning material because the available teaching media are very limited. In distance learning like this, it is very necessary to have interactive teaching media and can improve good learning. This study aims to produce STEAM-based interactive teaching media in social studies lessons for fifth grade elementary school students. This study uses the ADDIE model. The subjects in this study were 1 subject matter expert, 1 design and instructional media expert and 25 grade 5 students. The method of data collection in this study was a test, namely an objective test and a non-test, namely a questionnaire questionnaire. The results of the study were obtained from the results of the subject matter expert test, namely 89.58%, the learning design test 96.42%, the learning media expert test 93.75%. individual test 92.5%, small group test 91.66%, and field test 86.1%. From the research results, STEAM-based teaching media is good for social studies learning for fifth grade elementary school students. This research produces STEAM-based interactive teaching media to improve good learning.

Keywords: Teaching media, Social Studies Learning, STEAM.

1. INTRODUCTION

The COVID-19 pandemic threatens educational activities from schools to universities in Indonesia, this raises concerns about education and learning. Government policies make educational institutions prefer to stop face-to-face learning activities, including laboratories, and move educational activities to an online environment or online learning to prevent this covid-19 (Butnaru et al., 2021). Online learning has become the main choice so that learning can continue (Herwin et al., 2021). In order to keep online learning going well, teachers are expected to be able to adapt to this pandemic situation, teachers must be able to master technology or have computer literacy competencies (Karatas & Arpaci, 2021). Good learning process activities are processes with actions based on reciprocal relationships carried out between teachers and students so that later they achieve certain goals (Nurpratiwiningsih & Setiyoko, 2018). In this online learning, the teacher does not only give assignments, but there must be interaction and reciprocal relationships between teachers and students (Zaini et al., 2021). So that online learning can lead to reciprocal relationships or there is interaction in it,

the teacher must create teaching media that are in accordance with the current pandemic situation (Nasution, 2019). Teaching media are all media intended for learning including teacher aids when teaching or means of information from sources to recipients of information (students) so that learning objectives can be conveyed (Taufik et al., 2021). Teaching media is a means used as a liaison between subject developers and students (Yuanta, 2019).

Teaching media is indeed very important and contributes to the delivery of material. The goal is to improve learning that is effective, easy to understand and not boring. Teachers must master sufficient and good knowledge and understanding of teaching media (Arsyad, 2019; Irfan et al., 2019). If the manufacture of media always utilizes technology, it will make the media more interesting and interactive so that it can motivate all students (Sitompul & Sihombing, 2018) in addition to teaching media with learning media with technology such as computer simulations, it can foster active learning strategies. So teachers have to face changes in how to deliver effective and practical learning materials (MZ & Syafi'i, 2021).

The use of this teaching media must be accompanied by the right approach as well. One of the appropriate approaches in the 21st century is the STEAM approach. The STEAM approach is one of the learning approaches given to students so that students get the opportunity to have hands-on experience, and get involved in real problems and add insight such as communication skills, critical thinking skills, leadership, teamwork, creativity, resilience, and skills (Zan , 2016; Ozkan & Umdu Topsakal, 2021). This STEAM approach combines Science, Technology, Engineering, Art and Mathematics. With this STEAM approach, it involves a very creative process and does not use one method, the relevant learning in it will prepare students to enter as innovators for the future of the nation and state.

However, it can be seen that this online learning makes most students unable to understand the material well, and not all teachers can use technology in this online learning (Herwin et al., 2021). In fact, online learning involves a lot of technology (Pradnyaswari & Wulandari, 2021). In addition, based on the results of observations made with one of the fifth grade teachers in elementary school, it can be seen that most students do not understand social studies material because the available teaching media are very limited. In addition, in the implementation of physical distancing to reduce the spread of COVID-19 with data from January 22, 2020 (A. Rothan & N. Byrareddy, 2020) to date, there is less direct interaction between teachers and students in learning. The media used by the fifth grade elementary school teacher is whatsapp group and google classroom and the teacher downloads material from youtube. Sometimes teachers use zoom when explaining math learning only, but when other lessons the teacher only provides videos that are downloaded via youtube. The teaching media is considered by the teacher to be inaccurate because it has not been able to deliver the material optimally, seen from the fact that there are still students who do not understand the material. Based on the problems that have been described, the solution that can be taken is that it is necessary to develop a STEAM-based, innovative, and interactive teaching media needed by teachers and students. Many researchers have discussed that STEAM-based teaching media is very suitable for use in learning (SUEDA et al., 2021), learning media with the STEAM learning model are easy to implement (Dwi Sari & Setiawan, 2020). Based on this, it can be believed that this STEAM-based interactive teaching media is very feasible to use and become a solution in this online learning.

In previous research, teaching media were only made as learning videos. In this study, STEAM-based interactive teaching media is in the form of learning videos in which materials and questions are added and made as interesting as possible. In addition, it is STEAM-based which is expected to make students learn in 5 disciplines and it is easier to understand the learning material. The purpose of this research is to produce STEAM-based interactive teaching media that can be used in classroom learning and during this pandemic so as to make learning more interesting and students can master the material well.

2. METHOD

Development of teaching media in this study uses the ADDIE development model (Analysis, Design, Development, Implementation and Evaluation) . The ADDIE model is a five-step process for developing iterative lessons and training (Tu et al., 2021). The stages in the ADDIE development model are the analysis stage, whichis the stage of collecting initial data information for product development that is tailored to the needs of the school. Next is the design stage ,at this stage ideas and concepts are developed in the product so that it can be continued at the development stage , which is the physical implementation stage of all forms of media design that have been prepared previously at the design stage into an actual product. Next is the implementation stage ,at this stage the product that has been made will be used in learning, and the last is the evaluation stage, in this section a product evaluation is carried out to find out the final result of the product, whether there are defects or weaknesses in the product. The evaluation carried out is only limited to formative evaluation which aims to collect effectiveness data. The following are the stages of the ADDIE model.
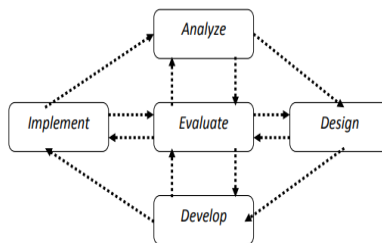

Figure 1. Stages of the ADDIE Model

Subjects of the product trial in this study were experts consisting of 1 subject matter expert, namely the homeroom teacher of class V SD, learning design experts and learning media experts who are lecturers at Ganesha Education University who have qualifications related to the field of educational technology, and 25 elementary school fifth grade students. The data collection method used to obtain data and information from this study used non-test and test methods. The non-test method used is in the form of a questionnaire or questionnaire, observation and interviews and the test method in the form of an objective test (test person) to be tested and can produce test scores. The data collection instrument in this study used a questionnaire sheet or a questionnaire made using a Likert scale. There are two types of data in this study, namely qualitative data and quantitative data. Qualitative data were taken from observation data, interviews and the results of reviews from experts, namely subject content experts, learning design experts, and learning media experts as well as responses or responses from students which included individual trials and small group trials. Quantitative data is obtained by converting the answers from the questionnaire using a Likert scale. The Likert scale is a psychometric scale commonly used in research that uses a questionnaire as a data collection instrument. The scale consists of 4 points with a score of 4 strongly agree, 3 agree, 2 disagree, 1 strongly disagree (Amin et al., 2021).
The following is a lattice of this research instrument.

Table 1. Rating Category Likert Scale

Score	Description
Score 1	Strongly disagree
Score 2	Disagree
Score 3	Agree
Score 4	Strongly agree

Table 2. Grid of *Review* Subject Content

Aspects	Indicators
Curriculum	Suitability of the material with KD
	The suitability of the material with the learning indicators
	The suitability of the material with the learning objectives
Material	Truth of the material
	Coverage of the material
	The importance of the material
	Interesting material
	The material is easy to understand
	The material is useful for students in real life
	Level Difficulty
In Grammar	Correct and consistent
	Language The language used is in accordance with the characteristics of the students

Table 3. Grid of *Review* Learning Design

Aspect	Indicators
Objectives	Clarity of general learning
	Objectives Conformity of learning objectives with media
	Conformity of learning stages with materials
Strategies	Providing learning motivation
	Presentation of interesting material
Evaluation	Given to measure the ability of students

Table 4. Grid of *Review* Learning Media Expert

Aspect	Indicators
Display	Quality of display
Text	Readability
Image	Suitability of images
Color	Composition and combination the right color and match
Sound	Use of appropriate music

Table 5. Grid Individual Trial Questionnaire, Small Group Test, and Field Test

Aspect	Indicators
	Ease of use of teaching media
Text	Readability of text
	Use of font size and type
Image	Material
Motivational	Teaching media can inspire student motivation
Materials	Are easy to understand
	Learning objectives are easy to understand
	Appropriateness
Evaluation	Provide feedback on evaluation results

The instrument trial was conducted to determine the feasibility of the instrument used to collect data in the study. The instrument trial used a used trial, meaning that the instrument was tested by being used directly on the sample to obtain research data. Before using the instrument, it went through the theoretical/logical validation stage by first consulting with the supervisor to determine the suitability of the indicator with the statement items in the questionnaire and the suitability of the indicator with the items in the test. The instrument that will be used in the field will first be tested for validity and reliability to determine the quality of the instrument. The instrument must meet several important requirements, including (1) the validity of the test items, (2) the reliability of the test, (3) the distinguishing power of the test, and (4) the level of difficulty of the test items.

In this development using 3 data analysis techniques, namely the first qualitative descriptive analysis technique, this data analysis technique is carried out by grouping information from qualitative data in the form of contributions, comments, criticisms and suggestions for improvement contained in the questionnaire and interview results. The results of the data analysis are then used to review the products developed. Second, quantitative descriptive analysis is a method of data processing that is carried out by systematically compiling in the form of numbers and or percentages regarding an object under study, in order to obtain general conclusions (Agung, 2018). In this study, quantitative descriptive analysis was used to process the data obtained through a questionnaire in the form of scores. The determination used in giving meaning and decision making in this study, is to use the achievement level conversion table with a scale of 5 as follows.

Table 3. Conversion of Achievement Levels with a 5 Scale

Rate Achievement (%)	Qualification
90 - 100 %	Very Good
75 - 89 %	Good
65 - 74 %	Enough
55- 64 %	Poor
0 - 54 %	Very Poor

Third, inferential statistical analysis is used to determine the level of product effectiveness on student learning outcomes before and after using the product. Field trial data were collected using pre-test and post-test on the subject matter, namely the content of social studies, which was tested. The results of the pre-test and post-test were then analyzed using the t-test to determine the difference between the results of the pre-test and post-test. Before testing the hypothesis (sample dependent t-test) a prerequisite test (normality) was conducted.

3. RESULT AND DISCUSSION

Result

Design of this STEAM-based interactive teaching media uses the ADDIE model which includes the analysis stage, design stage, development stage, implementation stage, and evaluation stage. The first stage that was carried out was at the analysis stage,there were 3 analyzes carried out at this stage, namely the analysis of the initial conditions, the researchers made direct observations of online learning carried out in fifth grade elementary school to determine the initial conditions of the online learning process. From the results of observations, on the course of learning, it can be seen that in the online learning process the teacher uses whatsapp groups and google classroom. In addition, the teaching media used are less interactive. Then the needs analysis, the researchers conducted a face-to-face needs

analysis by interviewing the homeroom teacher and distributing questionnaires to fifth grade elementary school students and distributing google forms to students. From the results of interviews with homeroom teachers for fifth grade elementary school, it is known that in the online learning process there is a lack of teachers using whatsapp groups and google classroom and teachers downloading materials from youtube. Based on the results of the google form filled in by class V students, it can be seen that when the teacher sends a video to the google classroom or whatsapp group the material makes the students quite understand or a bit difficult to understand. And the analysis of basic competencies and indicators, the researchers conducted interviews with the homeroom teacher of class V SD to find out the content of the material that was felt to require interactive teaching media. Based on the results of the interview, it is known that in the social studies content the material is Theme 2, Sub-theme 3, Learning 3.

Table 4. Mapping of KD & Indicators in Developed Media

Content	Basic Competencies	Indicators
PPKn	Understand rights, obligations and responsibilities as citizens in everyday life.	Give an example of responsibility as a citizen of the community to the problems that exist. Explain the consequences that occur if the community is not responsible for the waste problem.
Indonesian	Classifies the information obtained from the book into aspects: what, where, when, who, why, and how	Explain the information in the text related to what, who, when, where, how, and why questions. Analyze the information in the text related to what, who, when, where, how, and why questions.
Social Studies	Analyzes the role of the economy in an effort to improve the welfare lives in the social and cultural fields to strengthen the unity and integrity of the nation.	Analyzing the types of businesses and economic activities of the community. Analyze how to appreciate the economic efforts of others.

Stage design. At this stage ideas and concepts are developed in the product, the purpose of which is to facilitate the product manufacturing process so that the resulting product has a specific and solid design and will be at the development stage before running the final. This stage includes data collection, making flowcharts and sketches (storyboard) of STEAM-based interactive teaching media. The third stage, after the design process is the development stage . material power point , making videos, editing processes, adding interactivity, making product validity questionnaires for experts, and making product test questionnaires for students.
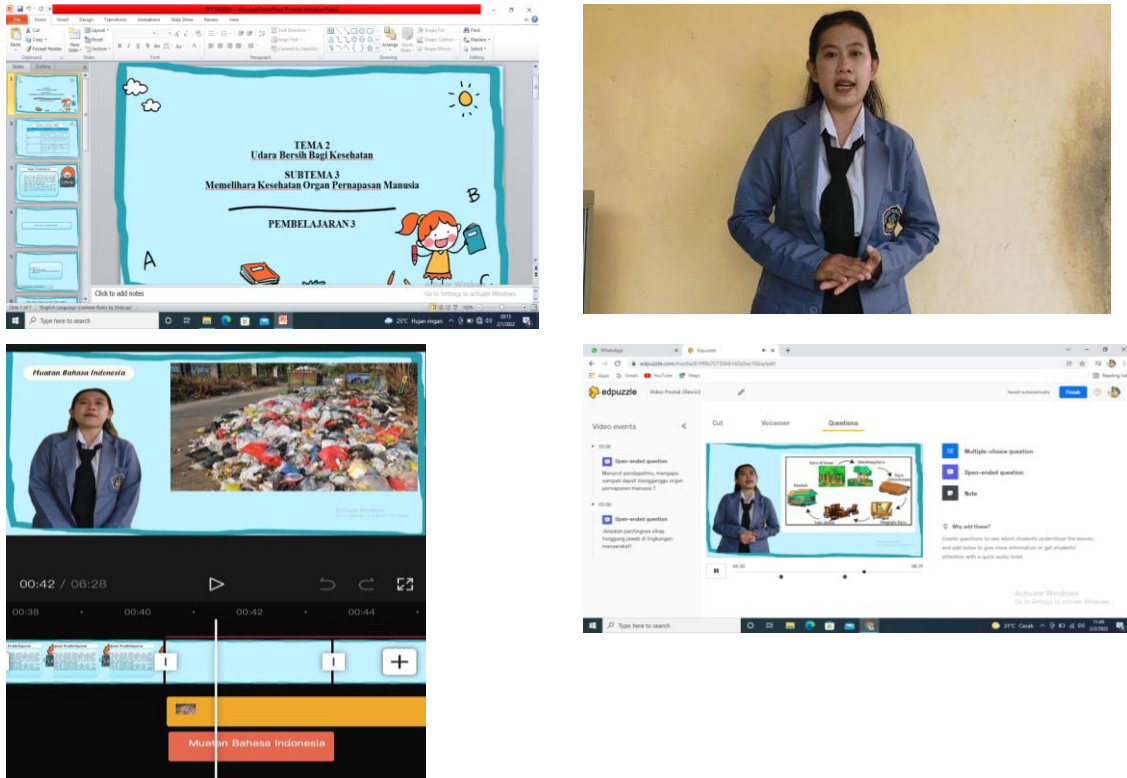
Figure 2. Product Development Results

The fourth stage, the implementation stage, the researchers conducted a product validity test by experts, the product trial was applied to the fifth grade of elementary school, and before learning was implemented, a pre-test to determine the students' prior knowledge, after that product can be used. Next is a posttest to see if there are differences in learning outcomes before and after using STEAM-based interactive teaching media. The results of the validity by experts and student trials are as follows.

Table 5. Results of Product Development Validity

No	Subject Test	Results Validity (%)	Qualification Percentage
1	Subject Content Expert Test	89,58	Good
2	Learning Design Expert Test	96,42	Very good
3	Learning Media Expert Test	93,75	Very good
4	Individual Trial	92,5	Very good
5	Small Group Test	91,66	Very good
6	Field Trial	86,1	Good

Based on Table 5, it shows that the percentage of the results of the validity of the development of STEAM-based interactive teaching media according to the test subjects are 89.58%, 96.42%, 93.75%, 92.5% , 91.66%, and 86.1%. The product revision was carried out after the product feasibility was assessed by 3 expert experts, namely subject content expert test, learning design expert test, learning media expert test as well as suggestions and opinions from the results of individual trials, small group trials, and field trials. The last stage is the evaluation stage, in this section a product evaluation is carried out as to find out the final result of the product, whether there are defects or weaknesses in the product. The effectiveness of research development products in this study was measured by conducting a

pre-experimental stage using a pretest and posttest on 25 fifth grade elementary school students. Based on the pretest and posttest scores of the 25 students, a t-test was carried out for the dependent sample. Prior to testing the hypothesis (dependent sample t test) a prerequisite test was conducted, namely the normality test. The normality test was carried out to determine whether the distribution of scores on each variable was normally distributed or not, for that the Chi-Square formula could be used. After being calculated using the Chi Square formula, the results of the pre-test X^2_{count} 7.480299 < X^2_{table} 11.0705, it can be concluded that the pre-test sample came from a normally distributed population. While the results of the normality test in the posttest obtained the results of the calculation X^2_{count} 8.380201 < X^2_{table} 11.0705 So it can be concluded that the post-test sample comes from a normally distributed population. Based on the results of the normality test, it was found that the data was normal, so the hypothesis was tested using the sample dependent t-test formula.

Table 6. Effectiveness Test Results

Data	N	Mean	Standard Deviation	db	$t_{arithmetic}$	t_{table}	Description
Pre test	25	61	26,8	24	3	1,7	*Significant*
Post test		72	19,4				

The results of the trial were compared to t_{table} with a significant level of 0.05 (5%) to determine the effectiveness of using STEAM-based interactive teaching media. With db = n-1 = 25-1 = 24, t $_{table}$ at a significance level of 5% for testing the directional hypothesis of 1.711, it can be seen that t_{count} > t_{table}. So that Ho is rejected, Ha is accepted. In conclusion, there is a significant difference between before and after using STEAM-based interactive teaching media on the learning outcomes of Social Studies content Theme 2, Sub-theme 3, Learning 3 for fifth grade elementary school.

Discussion

Product development, this development research resulted in a STEAM-based interactive teaching media in social studies lessons. Teaching media are tools used by teachers in learning so that learning will be meaningful because teachers will consider the condition of students each time they prepare media (Twiningsih & Elisanti, 2021). This teaching media is based on the STEAM approach which is able to develop individual abilities in expression and the most important thing is to innovate using various types of technology and art which can also improve the development of cognitive skills (Hsiao & Su, 2021). STEAM is a new vision to introduce creativity and collaboration so as to focus good graduates on a job (Belbase et al., 2021). STEAM incorporates problem-based, project or inquiry-based learning (Boice et al., 2021). This teaching media measures the social science knowledge competence of fifth grade elementary school students, competence is something that leads to behavior according to demands that will bring the desired results (Rasto et al., 2021). Social studies learning can help students' personal development in literacy and concern for community conditions by applying social science methods (Maksum et al., 2021). The scope of social studies is closely related to humans as members of society and is accompanied by values that characterize educational programs (Sulfemi & Mayasari, 2019). Social studies learning is more about interacting socially with the surrounding environment that integrates social science (Miaz et al., 2019) .

This STEAM-based interactive teaching media was developed using the ADDIE model and has been tested by 3 experts and after that product trials were carried out. In the first stage, the subject matter expert test was carried out, the instrument used for the subject

content expert trial was a questionnaire/questionnaire. After being converted to the achievement level conversion table with a scale of 5, the percentage of the achievement level is 89.58% with good qualifications because the presentation of the material is in accordance with the demands of achieving competency standards and basic competencies owned by the school. In the second stage, namely the learning design expert test, after being converted to the level of achievement with a scale of 5, the score is 96.42% with very good qualifications. Furthermore, at the learning media expert test stage after being converted to the level of achievement with a scale of 5, the score is 93.75% with very good qualifications. After testing the experts, it was followed by testing with students, namely individual trials, converted to a scale of 5 achievement table, a score of 92.5% was obtained with very good qualifications, then in the small group trial, a score of 91.66% was obtained with very good qualifications. , and the last field trial with a result of 86.1% with good qualifications. After the validity of the product is obtained, then the product effectiveness test is carried out with a result of 1.711, it can be seen that . So that Ho is rejected, Ha is accepted. In conclusion, there is a significant difference between before and after using STEAM-based interactive teaching media on the learning outcomes of Social Studies content Theme 2, Sub-theme 3, Learning 3 for fifth grade elementary school.

Based on previous research, STEAM-based teaching media is able to produce a positive effect on students' creativity, which seems to be associated with both original and new educational scenarios (Aguilera & Ortiz-Revilla, 2021). In addition, research shows that STEAM-based teaching media are able to appear creative and innovative by utilizing integrated technology in accordance with the 2013 curriculum in elementary schools (Pasani & Amelia, 2021). STEAM-based teaching media also provide opportunities for students to create projects that support each activity, collaboration and tolerance (Sudana Degeng et al., 2021). The advantages of this STEAM-based interactive teaching media are that this media is in the form of a learning video, this STEAM-based learning video with details in the field of Science , students can establish concepts through investigative activities such as observing objects or repeated experiments to determine the correct and relevant answers in the material presented. explained in the video that is on the product. In the field of Technology, this product is made with a power point application that can later be accessed using a cellphone. In the field of Engineering, the video contained in this product is related to the real life of students (White & Delaney, 2021). In the field of Art, in this product there are animations and interesting pictures and audio. And finally the field of Mathematics, this product contains learning material in the real world through higher-level thinking. In addition, video media can display a phenomenon that can be seen in real terms by students and this video can make the teaching and learning process in the classroom more lively and active because students' curiosity will definitely emerge (Octavyanti & Wulandari, 2021). In addition, this teaching media has added interactivity made with the Edpuzzle, so in this teaching media video there are 3 questions for each content.

The implication of this research is that it is empirically proven that by using STEAM-based interactive teaching media, learning becomes more fun and students can better understand the material. The average value after using STEAM-based interactive teaching media is higher than before using STEAM-based interactive teaching media. Based on this, STEAM-based interactive teaching media can be applied to learning taking place in the classroom or during distance learning to improve learning better. For the development of knowledge, this STEAM-based interactive teaching media can be used on other materials or on other themes that are adapted to the learning design of the learning materials. The limitation in this study is that the results of this teaching media product can only be used on Android smartphones, and are limited to 1 learning only, namely in class V Theme 2 Sub-

theme 3 Learning 3. Based on these limitations, it is necessary to have a teaching media research that includes material covered, more wider.

4. CONCLUSION

This study resulted in STEAM-based interactive teaching media, designed using the ADDIE model which has been tested by experts and product trials have been carried out, and can improve good learning seen from the results of the pretest and posttest. Based on this, the STEAM-based interactive teaching media is suitable for use in classroom learning and learning during a pandemic to improve good learning.

5. REFERENS

A. Rothan, H., & N. Byrareddy, S. (2020). A Framework for Five Big V's of Big Data and Organizational Culture in Firms. *Proceedings - 2018 IEEE International Conference on Big Data, Big Data 2018*, *January*, 5411–5413. https://doi.org/10.1109/BigData.2018.8622377.

Aguilera, D., & Ortiz-Revilla, J. (2021). Stem vs. Steam education and student creativity: A systematic literature review. *Education Sciences*, *11*(7). https://doi.org/10.3390/educsci11070331.

Agung, A. A. G. (2018). *Metodolofi Penelitian Kuantitatif (Perspektif Manajemen Pendidikan)*. Universitas Pendidikan Ganesha.

Amin, A., Alimni, A., Kurniawan, D. A., Azzahra, M. Z., & Septi, S. E. (2021). Parental Communication Increases Student Learning Motivation in Elementary Schools. *International Journal of Elementary Education*, *5*(4), 622. https://doi.org/10.23887/ijee.v5i4.39910.

Belbase, S., Mainali, B. R., Kasemsukpipat, W., Tairab, H., Gochoo, M., & Jarrah, A. (2021). At the dawn of science, technology, engineering, arts, and mathematics (STEAM) education: prospects, priorities, processes, and problems. *International Journal of Mathematical Education in Science and Technology*. https://doi.org/10.1080/0020739X.2021.1922943.

Boice, K. L., Jackson, J. R., Alemdar, M., Rao, A. E., Grossman, S., & Usselman, M. (2021). Supporting teachers on their STEAM journey: A collaborative STEAM teacher training program. *Education Sciences*, *11*(3), 1–20. https://doi.org/10.3390/educsci11030105.

Butnaru, G. I., Niță, V., Anichiti, A., & Brînză, G. (2021). The effectiveness of online education during covid 19 pandemic—a comparative analysis between the perceptions of academic students and high school students from romania. *Sustainability (Switzerland)*, *13*(9). https://doi.org/10.3390/su13095311.

Dwi Sari, N., & Setiawan, J. (2020). Papan Gekola Sebagai Media Pembelajaran Matematika Yang Inovatif Dengan Pendekatan Steam. *Jurnal Sains Dan Matematika Unpam*, *3*(1), 31–41. https://www.researchgate.net/publication/346332865_Papan_Gekola_Sebagai_Media _Pembelajaran_Matematika_Yang_Inovatif_Dengan_Pendekatan_STEAM.

Herwin, H., Hastomo, A., Saptono, B., Ardiansyah, A. R., & Wibowo, S. E. (2021). How elementary school teachers organized online learning during the covid-19 pandemic? *World Journal on Educational Technology: Current Issues*, *13*(3), 437–449. https://doi.org/10.18844/wjet.v13i3.5952.

Hsiao, P. W., & Su, C. H. (2021). A study on the impact of steam education for sustainable development courses and its effects on student motivation and learning. *Sustainability (Switzerland)*, *13*(7), 1–24. https://doi.org/10.3390/su13073772.

Irfan, I., Muhiddin, M., & Ristiana, E. (2019). Pengembangan Media Pembelajaran IPA Berbasis Powerpoint di Sekolah Dasar [Powerpoint-Based Science Learning Media Development in Elementary Schools]. *Indonesian Journal of Primary Education*, *3*(2), 16–27. https://doi.org/http://ejournal.upi.edu/index.php/IJPE/index -.

Karatas, K., & Arpaci, I. (2021). The role of self-directed learning, metacognition, and 21st century skills predicting the readiness for online learning. *Contemporary Educational Technology*, *13*(3). https://doi.org/10.30935/cedtech/10786.

Maksum, A., Widiana, I. W., & Marini, A. (2021). Path analysis of self-regulation, social skills, critical thinking and problem-solving ability on social studies learning outcomes. *International Journal of Instruction*, *14*(3), 613–628. https://doi.org/10.29333/iji.2021.14336a.

Miaz, Y., Helsa, Y., Zuardi, Yunisrul, Febrianto, R., & Erwin, R. (2019). The development of interactive multimedia-based instructional media for elementary school in learning social sciences. *Journal of Physics: Conference Series*, *1321*(3). https://doi.org/10.1088/1742-6596/1321/3/032107.

MZ, A. B., & Syafi'i, I. (2021). The Development of Learning Media of Islamic Education Based on Flipbook in Covid-19 Pandemic at Elementary School. *Halaqa: Islamic Education Journal*, *5*(1), 43–62. https://doi.org/10.21070/halaqa.v5i1.1209.

Nasution, E. (2019). Problematika pendidikan di Indonesia. *Jurnal Fakultas Ushuluddin Dan Dakwah IAIN Ambon*, 1–10. https://doi.org/10.31227/osf.io/u9wg2.

Nurpratiwiningsih, L., & Setiyoko, D. T. (2018). Development of Education Games Map Material as a Learning Media for Elementary School Students. *Journal of Primary Education*, *8*(3), 249–257. https://doi.org/https://doi.org/10.15294/jpe.v8i3.26251.

Octavyanti, N. P. L., & Wulandari, I. G. A. A. (2021). Pengembangan Video Pembelajaran Berbasis Pendekatan Kontekstual Pada Mata Pelajaran Matematika Kelas IV SD. *Jurnal Edutech Undiksha*, *9*(1), 66–74. https://doi.org/10.23887/jeu.v9i1.32223.

Ozkan, G., & Umdu Topsakal, U. (2021). Investigating the effectiveness of STEAM education on students' conceptual understanding of force and energy topics. *Research in Science and Technological Education*, *39*(4), 441–460. https://doi.org/10.1080/02635143.2020.1769586.

Pasani, C. F., & Amelia, R. (2021). Introduction of the integrative STEAM approach as a learning innovation in the COVID-19 pandemic in South Kalimantan. *Journal of Physics: Conference Series*, *1832*(1). https://doi.org/10.1088/1742-6596/1832/1/012029.

Pradnyaswari, N. P. D., & Wulandari, I. G. A. A. (2021). Supporting and Inhibiting Factors for Online Learning in the Covid-19 Period in Elementary School Teachers. *Proceedings of the 2nd International Conference on Technology and Educational Science (ICTES 2020)*, *540*(Ictes 2020), 455–460. https://doi.org/10.2991/assehr.k.210407.278.

Rasto, R., Muhidin, S. A., Islamy, F. J., & Handayani, D. (2021). The influence of knowledge sharing and competence on academic performance. *Cypriot Journal of Educational Sciences*, *16*(3), 928–938. https://doi.org/10.18844/CJES.V16I3.5764.

Sitompul, D. R. P., & Sihombing, P. (2018). A teaching media of using the busy bit and SDCC in displaying character string on LCD in MCU 8051 IDE. *Alexandria Engineering Journal*, *57*(2), 813–818. https://doi.org/10.1016/j.aej.2017.01.037.

Sudana Degeng, I. N., Sutadji, E., Esa Pramudita Rinanityas, Y., Prihatin, R., Priawasana, E., Mais, A., & Usman, U. (2021). The Effect of PBL-based STEAM Approach on The Cognitive and Affective Learning Outcomesof Primary School. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, *12*(6), 2390–2399. https://doi.org/10.17762/turcomat.v12i6.5521.

SUEDA, K., K. Yamazaki, A., Nomura, M., Sakamato, M., Kato, Y., & Hosaka, M. (2021). Open Source-Based UAVs for STEAM Education: Some Case Studies. *International Journal of Learning and Teaching*, *7*(3), 202–206. https://doi.org/10.18178/ijlt.7.3.202-206.

Sulfemi, W. B., & Mayasari, N. (2019). The Use Of Audio Visual Media In Value Clarification Technique to Improve Student Learning Outcomes In Social Studies. *Jurnal Pendidikan*, *20*(1), 53. https://doi.org/10.33830/jp.v20i1.772.2019.

Taufik, M. S., Ridlo, A. F., Solahuddin, S., Iskandar, T., & Taroreh, B. S. (2021). Application of YouTube-Based Virtual Blended Learning as a Learning Media for Fundamental Movement Skills in Elementary Schools during the Covid Pandemic 19. *Ann Appl Sport Sci*, *7*. https://doi.org/10.52547/aassjournal.1020 Application.

Tu, J. C., Zhang, X., & Zhang, X. Y. (2021). Basic courses of design major based on the addie model: Shed light on response to social trends and needs. *Sustainability (Switzerland)*, *13*(8). https://doi.org/10.3390/su13084414.

Twiningsih, A., & Elisanti, E. (2021). Development of STEAM Media to Improve Critical Thinking Skills and Science Literacy : A Research and Development Study in SD Negeri Laweyan Surakarta, Indonesia. *International Journal of Emerging Issues in Early Childhood Education*, *3*(1), 25–34. https://doi.org/10.31098/ijeiece.v3i1.520.

White, D., & Delaney, S. (2021). Full STEAM ahead, but who has the map for integration? - A PRISMA systematic review on the incorporation of interdisciplinary learning into schools. *LUMAT: International Journal on Math, Science and Technology Education*, *9*(2). https://doi.org/10.31129/LUMAT.9.2.1387.

Yuanta, F. (2019). Pengembangan Media Video Pembelajaran Ilmu Pengetahuan Sosial pada Siswa Sekolah Dasar. *Jurnal Pendidikan Dasar*, *1*(02), 91–100. https://doi.org/10.30742/tpd.v1i02.816.

Zaini, H., Afriantoni, Hadi, A., Sofyan, F. A., Faisal, Padjrin, & Hamzah, A. (2021). Covid-19 and Islamic Education in School: Searching for Alternative Learning Media. *Webology*, *18*(1), 154–165. https://doi.org/10.14704/WEB/V18I1/WEB18080.